SMPTE RECOMMENDED PRACTICE

Ultra High-Definition, 2048 x 1080 and 4096 x 2160 Compatible Color Bar Signal

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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in its Standards Operations Manual.

SMPTE RP 219-2 was prepared by Technology Committee 10E.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Engineering Document. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

This recommended practice describes color bar signals for 2048 x 1080 formats, 3840 x 2160 formats, 4096 x 2160 formats and 7680 x 4320 formats having standard dynamic range.

The color bar signals are based on the high-definition, standard-definition compatible color bar signal defined in SMPTE RP 219-1. The structure of the high definition, standard definition compatible color bar signal is maintained, including the central 4:3 aspect ratio part, so that a familiar signal will be generated if these signals are down converted or divided by 2-sample interleave division to HDTV signals, or further down converted and aspect ratio converted to SDTV signals. The +/- I and +Q options from SMPTE RP 219-1 are not included as it is considered unlikely that these signals will be converted to NTSC. The 2048 x 1080 format color bars differ from the 1920 x 1080 format color bars defined in SMPTE RP 219-1 in that they have wider left hand side and right hand side bars. The 3840 x 2160 and the 7680 x 4320 color bars differ from the 1920 x 1080 format color bars defined in SMPTE RP 219-1 in their spatial scaling.

1 Scope

This recommended practice specifies color bar patterns compatible with 2048 x 1080 formats, 3840 x 2160 formats, 4096 x 2160 formats and 7680 x 4320 formats having standard dynamic range.

The 2048 x 1080 and 4096 x 2160 color bar signals have default R′G′B′ colorimetry as defined in SMPTE ST 2048-1 “R′G′B′ Colorimetry”.

The 3840 x 2160 color bar signal can have conventional colorimetry or UHDTV colorimetry as defined in SMPTE ST 2036-1 “System Colorimetry”.

The 7680 x 4320 color bar signal has UHDTV colorimetry.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:”

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; then formal languages; then figures; and then any other language forms.

3 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this engineering document. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this engineering document are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE ST 352:2013, Payload Identification Codes for Serial Digital Interfaces

SMPTE ST 2036-1:2014, Ultra High Definition Television — Image Parameter Values for Program Production

SMPTE ST 2048-1:2011, 2048 × 1080 and 4096 × 2160 Digital Cinematography Production Image Formats FS/709

4 Color Bar Signal Structure

Each color bar signal shall be composed of four specific patterns, as shown in Figure 1.

Figure 1 shows the four patterns and their locations within the image format.

The dimensions a, b, c and d in Figure 1 are ideal dimensions, and can be calculated from the image format. For example, a 3840 x 2160 image format would have dimension a = 3840, dimension b = 2160, dimension c = (2160 x 4/3 x 1/7) = 411 $^{3}/_{7}$, and dimension d = ((3840 – (2160 x 4/3))) / 2 = 480.

In order to use integer dimensions, the widths of parts of the test pattern are modified from the ideal widths. Annex C defines values for a, b, c and d in Figure 1 for each image format, and introduces widths e, f, h, i, j, k and m for the modified widths.

4.1 Arrangement of Patterns

Pattern 1 shall consist of a 75% color bar signal within a 4:3 aspect ratio area, with 40% gray signals positioned on either side of the 4:3 area. The sub-pattern areas marked *1 within pattern 1 in Figure 1 (single bars on far left and far right of pattern 1) shall extend the 4:3 aspect ratio area to 16:9 for the 3840 x 2160 signal, and to 256:135 for the 2048 x 1080 and 4096 x 2160 signals. They shall be set to 40% gray as a default value. They may be set to any other value.

Pattern 2 shall consist of the color difference/chroma setting reference signal (75% white) within the 4:3 area, with 100% cyan and 100% blue signals to the far left and far right sides respectively. Additionally, a signal in the sub-pattern area marked *2 in Figure 1 shall be 75% white or 100% white.

Note: The signal in the sub-pattern area marked *2 in Figure 1 can also be +I or –I in the high-definition, standard-definition compatible color bar signal defined in SMPTE RP 219-1:2014. This is not an option for the color bar signals in this RP.

Pattern 3 shall consist of a ramp signal with 0% black and 100% white signals to the immediate left and right respectively within the 4:3 area, and 100% yellow and 100% red signals to the far left and far right sides respectively. The ramp signal is designed for checking specific bit failures that can occur in digital processing. The ramp shall be a linear slope of luminance code values from 0% to 100% white.

Note: The fact that the ramp is linear does not mean that it changes by a value of 1 for every pixel.

Additionally a signal in the sub-pattern area marked *3 in Figure 1 shall be 0% black.

Note: The signal in the sub-pattern area marked *3 in Figure 1 can also be +Q in the high-definition, standard-definition compatible color bar signal defined in SMPTE RP 219-1:2014. This is not an option for the color bar signals in this RP.

Pattern 4 shall consist of a 0% black signal divided vertically into three equal parts, a 100% white signal divided vertically into three equal parts, and a set of near-black signals for picture monitor black level adjustment, within the 4:3 area. The sub-pattern area marked *4 within pattern 4 in Figure 1 (single bars on far left and far right of pattern 4) shall be set to 15% gray as a default value. This value may be set to any other value.

Note: The set of near-black signals are known collectively as PLUGE (PLUGE: Picture Line Up Generating Equipment). For specific instructions see Section 5.3 and SMPTE EG 1, Section 4.2.

Additionally a signal in the sub-pattern area marked *5 in Figure 1 shall be a 0% black or a sub-black valley signal. The sub-black valley signal shall begin at the 0% black level, shall decrease in a linear ramp to the minimum permitted level at the mid-point, and shall increase in a linear ramp to the 0% black level at the end of the black bar. When the sub-black valley signal is selected in sub-pattern *5, the super-white peak signal shall be simultaneously selected in sub-pattern *6.

Additionally a signal in the sub-pattern area marked *6 in Figure 1 shall be a 100% white or a super-white peak signal. The super-white peak signal shall begin at the 100% white level, shall increase in a linear ramp to the maximum permitted level at the midpoint, and shall decrease in a linear ramp to the 100% white level at the end of the white bar. When the super-white peak signal is selected in sub-pattern *6, the sub-black valley signal shall be simultaneously selected in sub-pattern *5.

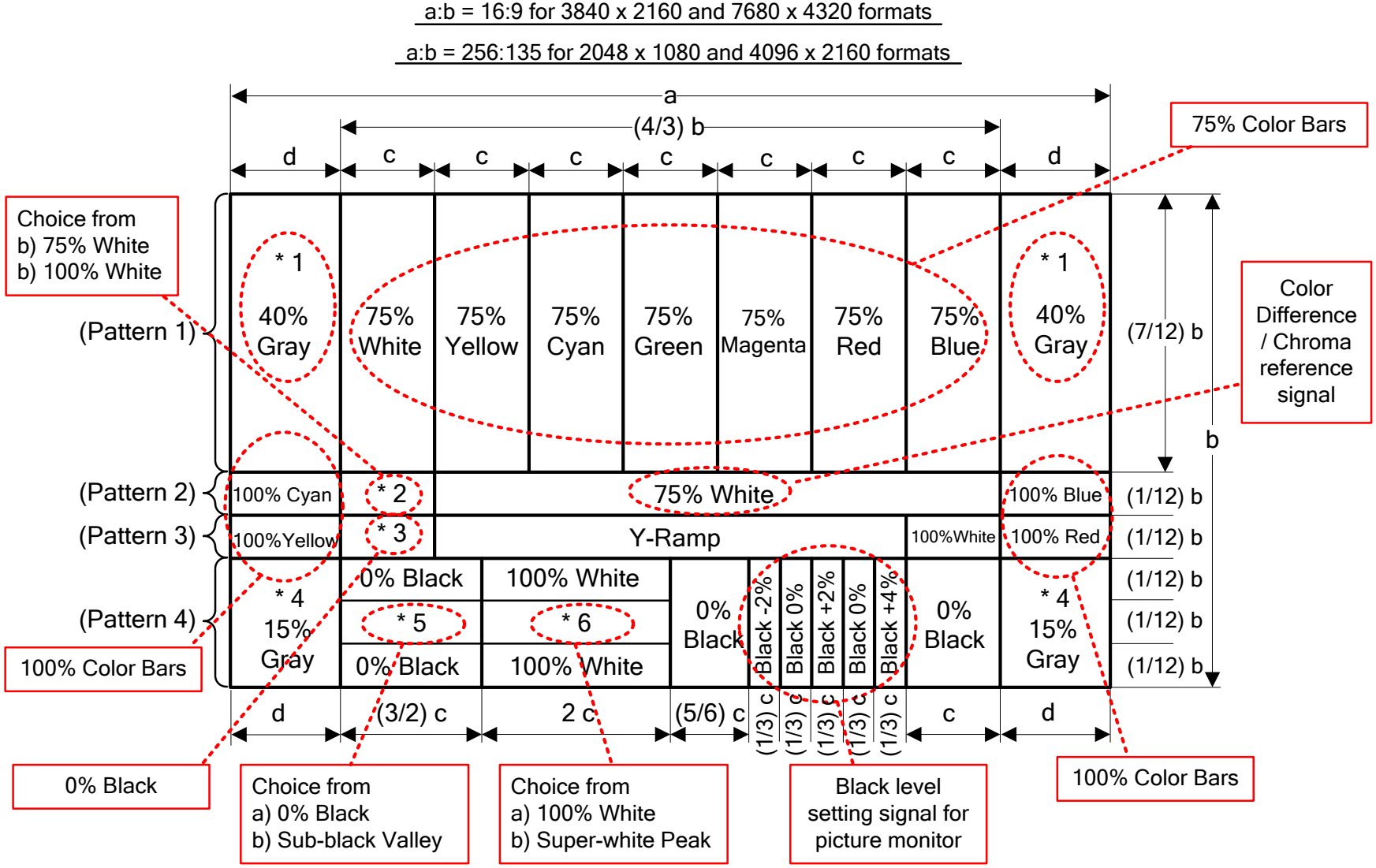

Figure 1 – Structure of the color bar signals

Note: This diagram shows the ideal widths and heights of each part of the test signal. In practice the widths of parts of the test pattern are modified from the ideal widths to fit the image format structure. Annex C defines actual values for a, b, c and d in Figure 1 for each image format, and introduces widths e , f, h, i, j, k and m for the modified widths.

4.2 Colorimetry

There are two colorimetries used in this Recommended Practice, one based on UHDTV reference primaries and one based on conventional reference primaries.

These two colorimetries are defined in SMPTE ST 2036-1.

Either colorimetry may be used for UHDTV1. UHDTV colorimetry is mandated for UHDTV2 signals

Conventional colorimetry shall be used for 2048 x 1080 and 4096 x 2160 signals.

Note: The R'G'B' values are the same independent of the colorimetry, but the $Y'C'_BC'_R$ values used to represent the R'G'B' values are different, as the R'G'B' to $Y'C'_BC'_R$ matrix equations are different for the two colorimetries.

The colorimetry shall be indicated in the SMPTE ST 352 payload identifier (PID) accompanying the color bar signal.

Note: If UHDTV color bars using UHDTV colorimetry are to be down-converted to HDTV, an appropriate colorimetry conversion process between the UHDTV and the down-converted HDTV color bar signals is suggested. See SMPTE RP 219-1 for details about further down conversion to SDTV.

4.3 Rise and Fall Times of Bar Transitions

Implementers of this Recommended Practice shall follow practices of proper shaping (rise and fall times for bar transitions) for individual bars.

Nominal values for rise and fall time of the color bars shall be identical for luminance and C'_B / C'_R signals, and set to 4 luminance sample periods, which does not exercise the full bandwidth capability of the system. These rise and fall time definitions are based on a transition from 10% to 90%. The tolerance on the rise/fall times shall be ± 10% of the nominal values. The actual shape of the transition should be similar to integrated sine-squared pulse shape.

4.4 Waveforms

Note: Values shown in Figure 2 through Figure 5 are associated with a 10-bit digital system with conventional colorimetry. Values shown in Figure 6 and Figure 7 are associated with a 10-bit digital system with either colorimetry. See Annex B for a complete listing of coding values for 10-bit and 12-bit digital systems with both conventional and UHDTV colorimetries.

4.4.1 Pattern 1

Waveforms defining pattern 1 are shown in Figure 2.

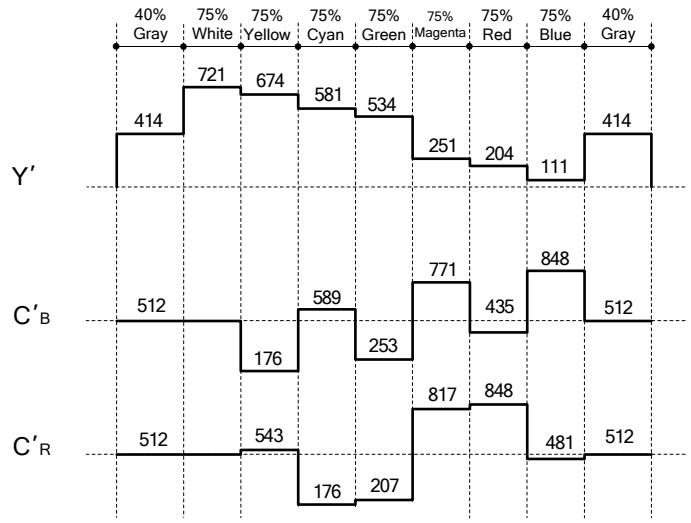

Figure 2 – Pattern 1 waveforms

4.4.2 Pattern 2

Waveforms defining pattern 2 are shown in Figure 3 and Figure 4 .

(a) Sub-pattern *2 set to 75% white signal:

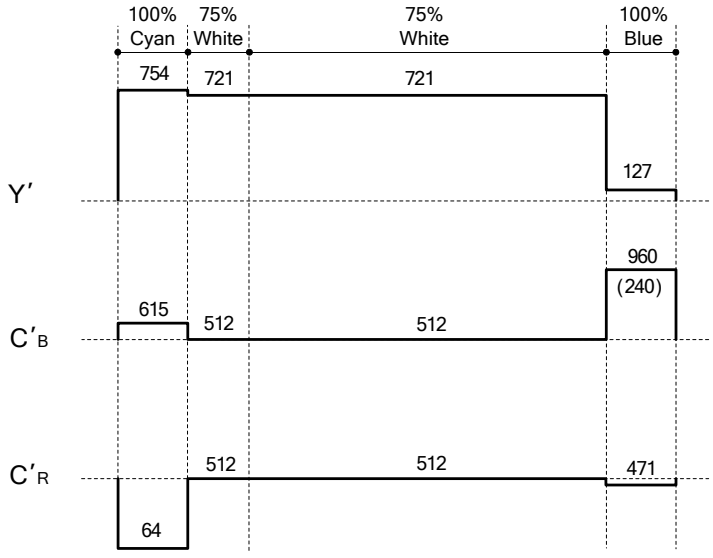

Figure 3 – Pattern 2 waveforms with 75% white signal (in *2 sub-pattern)

(b) Sub-pattern *2 set to 100% white signal:

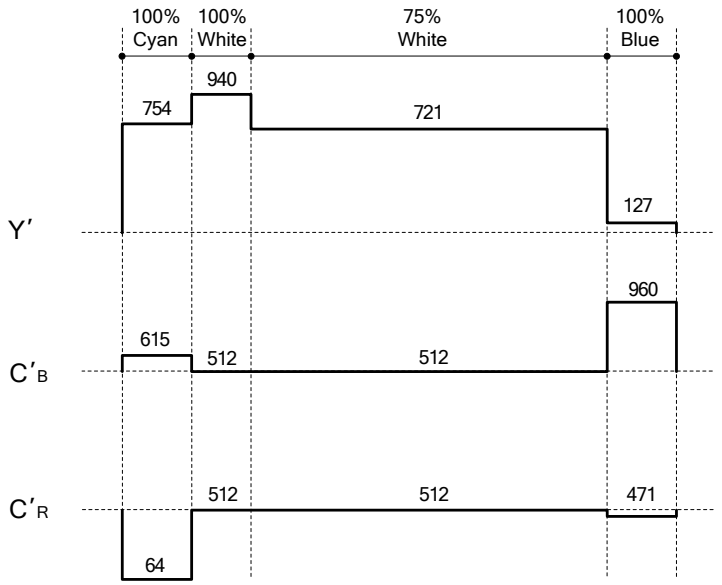

Figure 4 – Pattern 2 waveforms with 100% white signal (in *2 sub-pattern)

4.4.3 Pattern 3

Waveforms defining pattern 3 are shown in Figure 5 .

(a) Sub-pattern *3 set to black signal:

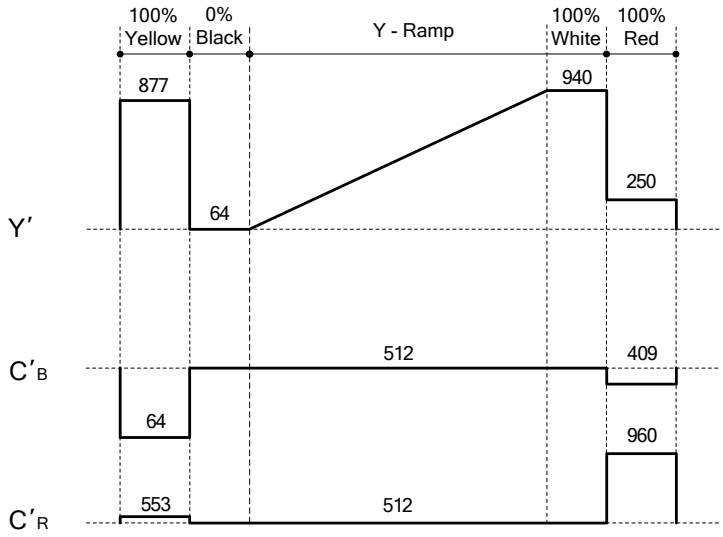

Figure 5 – Pattern 3 waveforms with black signal (in *3 sub-pattern)

4.4.4 Pattern 4

Waveforms defining pattern 4 are shown in Figure 6 and Figure 7.

(a) Sub-pattern *5 set to black signal and Sub-pattern *6 set to white signal:

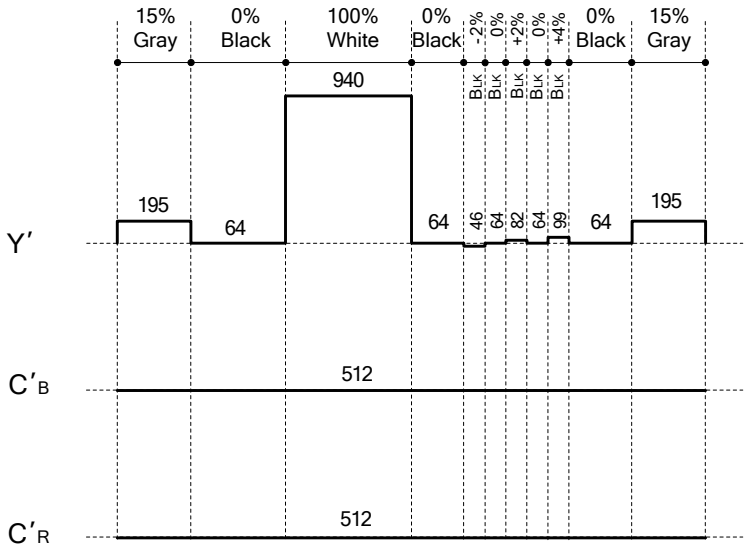

Figure 6 – Waveforms for pattern 4

(b) Sub-pattern *5 set to sub-black valley signal and Sub-pattern *6 set to super-white peak signal:

When the optional sub-black valley and optional super-white peak signals are used in sub pattern region *5 and *6 respectively, the top and bottom thirds of pattern 4 shall use the waveforms of Figure 6. The middle third of pattern 4 shall use the waveform of Figure 7.

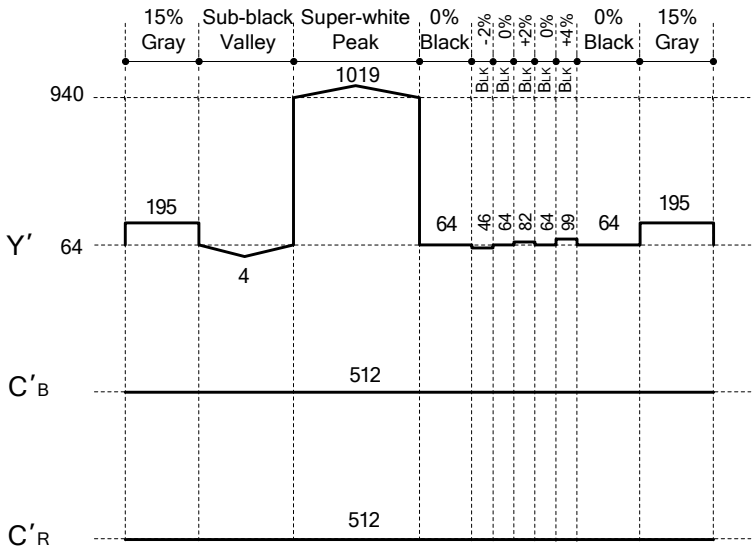

Figure 7 – Waveforms for pattern 4 with the sub-black valley (in *5 sub pattern) and super-white peak (in *6 sub pattern)

5 Use of the Color Bar Signals (Informative)

Values associated with % are related to a full value of the signal based on 100% of a full digital signal, defined in a relevant signal format document. See Annex B for a complete listing of coding values for 10-bit and 12-bit digital systems.

5.1 Monitor Adjustment

5.1.1 Adjustment of a component picture monitor

Turning on the blue channel only in the monitor, C'_B/P'_B gain is adjusted to give the same brightness level in the blue bars and the 75% white signal area located below the blue bars.

Turning on the red channel only in the monitor, C'_R/P'_R gain is adjusted to give the same brightness level in the red bars and the 75% white signal area located below the red bars.

5.2 Ramp Signal

A “Y ramp signal” located in the middle of the screen as part of pattern 3 allows easy monitoring of specific bit failures in a luminance signal.

5.3 PLUGE Signals for Picture Monitor Black Level Setup

The PLUGE signals in pattern 4 (-2, 0, +2, 0 and +4%) are a combination of signal sequences for picture monitor use. See note under pattern 4 in Section 4.1.

To set the black level in a picture monitor, the brightness control is adjusted until the +2% and the +4% steps are visible with respect to the black surround but the -2% step is not visible

This signal is not appropriate for setting black level on displays used for critical evaluation of images. A suitable signal for this purpose is specified in SMPTE RP 2080-2.

5.4 100% White Signal (Pattern 4)

This signal provides the standard level of 100% brightness.

5.5 Optional Sub-black Valley (Sub-pattern *5)

This signal is used to determine if equipment is capable of passing the minimum permitted luminance level, and if the monitor is capable of displaying it.

5.6 Optional Super-white Peak (Sub-pattern *6)

This signal is used to determine if equipment is capable of passing the maximum permitted luminance level, and if the monitor is capable of displaying it.

Annex A Digital Coding Values for 10- or 12-bit Implementation of Color Bar Signal using UHDTV Colorimetry (Normative)

Note: SMPTE ST 2036-1:2013 mandates the use of UHDTV colorimetry for UHDTV2 signals and recommends it for UHDTV1 signals.

The following tables specify the digital coding values that shall be used for 10-, or 12-bit implementations of the color bar signal using UHDTV colorimetry.

Pattern 1

Table A.1 – Digital Coding Values for Pattern 1

		75% White	75% Yellow	75% Cyan	75% Green	75% Magenta	75% Red	75% Blue	40% Gray
Y'	10-bit	721	682	548	509	276	237	103	414
	12-bit	2884	2728	2194	2038	1102	946	412	1658
C'_B	10-bit	512	176	606	270	754	418	848	512
	12-bit	2048	704	2423	1079	3017	1673	3392	2048
C'_R	10-bit	512	539	176	203	821	848	485	512
	12-bit	2048	2156	704	812	3284	3392	1940	2048

Pattern 2

Table A.2 – Digital Coding Values for Pattern 2: 75% White signal selected

		100% Cyan	75% White	100% Blue
Y'	10-bit	710	721	116
	12-bit	2839	2884	464
C'_B	10-bit	637	512	960
	12-bit	2548	2048	3840
C'_R	10-bit	64	512	476
	12-bit	256	2048	1904

Table A.3 – Digital Coding Values for Pattern 2: 100% White signal selected

		100% Cyan	100% White	75% White	100% Blue
Y'	10-bit	710	940	721	116
	12-bit	2839	3760	2884	464
C'_B	10-bit	637	512	512	960
	12-bit	2548	2048	2048	3840
C'_R	10-bit	64	512	512	476
	12-bit	256	2048	2048	1904

Pattern 3

Table A.4 – Digital Coding Values for Pattern 3: Black signal selected

		100% Yellow	0% Black	Ramp 100%	100% White	100% Red
Y'	10-bit	888	64	940	940	294
	12-bit	3552	256	3760	3760	1177
C'_B	10-bit	64	512	512	512	387
	12-bit	256	2048	2048	2048	1548
C'_R	10-bit	548	512	512	512	960
	12-bit	2192	2048	2048	2048	3840

Pattern 4

Table A.5 – Digital Coding Values for Pattern 4

		15% Gray	0% Black	Sub-black Valley	100% White	Super-white Peak	-2% Black	+2% Black	+4% Black
Y'	10-bit	195	64	4	940	1019	46	82	99
	12-bit	782	256	16	3760	4079	186	326	396
C'_B	10-bit	512	512	512	512	512	512	512	512
	12-bit	2048	2048	2048	2048	2048	2048	2048	2048
C'_R	10-bit	512	512	512	512	512	512	512	512
	12-bit	2048	2048	2048	2048	2048	2048	2048	2048

Annex B Digital Coding Values for 10- or 12-bit Implementation of Color Bar Signal using Conventional Colorimetry (Normative)

Note: SMPTE ST 2036-1:2013 permits the use of conventional HDTV colorimetry for UHDTV1 signals.

The following tables specify the digital coding values that shall be used for 10-, or 12-bit implementations of the color bar signal using conventional colorimetry.

Pattern 1

Table B.1 – Digital Coding Values for Pattern 1

		75% White	75% Yellow	75% Cyan	75% Green	75% Magenta	75% Red	75% Blue	40% Gray
Y'	10-bit	721	674	581	534	251	204	111	414
	12-bit	2884	2694	2325	2136	1004	815	446	1658
C'_B	10-bit	512	176	589	253	771	435	848	512
	12-bit	2048	704	2356	1012	3084	1740	3392	2048
C'_R	10-bit	512	543	176	207	817	848	481	512
	12-bit	2048	2171	704	827	3269	3392	1925	2048

Pattern 2

Table B.2 – Digital Coding Values for Pattern 2: 75% White signal selected

		100% Cyan	75% White	100% Blue
Y'	10-bit	754	721	127
	12-bit	3015	2884	509
C'_B	10-bit	615	512	960
	12-bit	2459	2048	3840
C'_R	10-bit	64	512	471
	12-bit	256	2048	1884

Table B.3 – Digital Coding Values for Pattern 2: 100% White signal selected

		100% Cyan	100% White	75% White	100% Blue
Y'	10-bit	754	940	721	127
	12-bit	3015	3760	2884	509
C'_B	10-bit	615	512	512	960
	12-bit	2459	2048	2048	3840
C'_R	10-bit	64	512	512	471
	12-bit	256	2048	2048	1884

Pattern 3

Table B.4 – Digital Coding Values for Pattern 3: Black signal selected

		100% Yellow	0% Black	Ramp 100%	100% White	100% Red
Y'	10-bit	877	64	940	940	250
	12-bit	3507	256	3760	3760	1001
C'_B	10-bit	64	512	512	512	409
	12-bit	256	2048	2048	2048	1637
C'_R	10-bit	553	512	512	512	960
	12-bit	2212	2048	2048	2048	3840

Pattern 4

Table B.5 – Digital Coding Values for Pattern 4

		15% Gray	0% Black	Sub-black Valley	100% White	Super-white Peak	-2% Black	+2% Black	+4% Black
Y'	10-bit	195	64	4	940	1019	46	82	99
	12-bit	782	256	16	3760	4079	186	326	396
C'_B	10-bit	512	512	512	512	512	512	512	512
	12-bit	2048	2048	2048	2048	2048	2048	2048	2048
C'_R	10-bit	512	512	512	512	512	512	512	512
	12-bit	2048	2048	2048	2048	2048	2048	2048	2048

Annex C Values for Construction of Color Bar Signal (Normative)

In Figure 1 and Figure C.1, dimensions a and b, the width and height respectively of the active image area, shall be as defined by the source image format standards SMPTE ST 2048-1 and SMPTE ST 2036-1.

The following values should be used for construction of the color bar signal. When the color bar signal is being generated, there are some simplifications that can be made to simplify the implementation depending upon design and/or manufacturing restrictions. Individual ideal parameters are shown in this recommended practice for reference, however some parameters have alternative values to simplify the implementation.

C.1 Bar Widths

The bar widths for picture elements of the color bar signal are specified as fractions of the total line width, so that the color bar signal is scalable between the different image formats. The number of samples for specific bar widths may therefore be a fraction, depending on the relationship of the number of horizontal picture elements to the total line width. For digital interfaces it is desirable for each picture element width to be an integer number of samples. Additionally, because of the 4:2:2 chroma sub-sampling, in order for the color difference signal to be an integer number of samples, the luminance signal should be an even number of samples. Further, because of the 2-sample interleave division for transport of UHDTV and 4096 x 2160 images, each bar should be a multiple of four luminance samples for UHDTV1 and 4096 x 2160 images, and a multiple of eight luminance samples for UHDTV2 images.

Note: As the bar edges are shaped, the center point of each bar edge can be positioned where desired, and is not limited to sample locations. The advantage of constraining bar edges as described is that the shaping can be similar for each bar edge, which can simplify implementation. Such constraint also means that any particular bar is the same width in all sub images.

At the edge of a picture element, shaping is applied in conformance with Section 4.3. It can be desirable to increase the width of the 4:3 central part of the color bar signal so there is an overlap at the edges when the signal is down-converted to a 4:3 SDTV color bar signal.

The following tables present three sets of recommended widths:

a. The ideal width, rounded to the closest integer

b. A compatible width which conforms to the requirements for 4:2:2 chroma sub-sampling and 2-sample interleave division

c. A modified 4:3 width, with the width of both 75% White and Blue bar regions increased to avoid any overlap at the 4:3 boundary when the color bar signal is down-converted to SDTV.

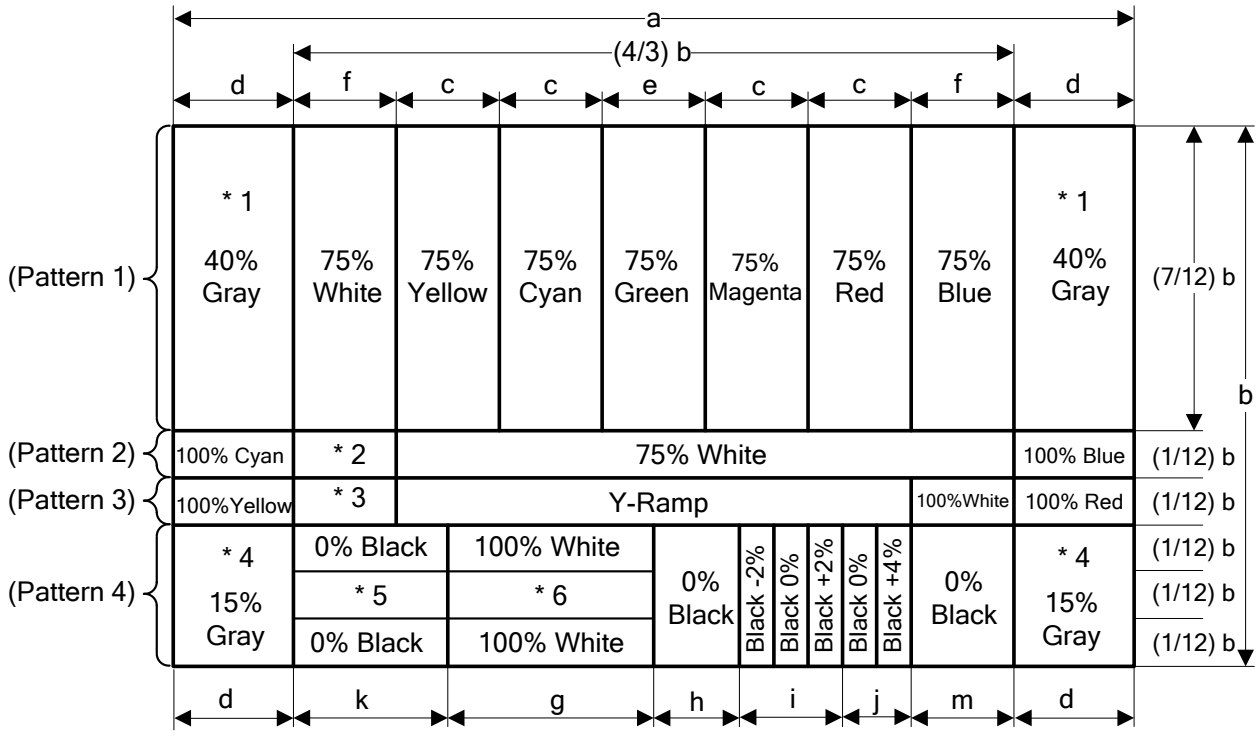

Figure C.1 – Reference diagram for Tables C.1 to C.8

Table C.1 – Bar widths for pattern 1 - 2048 x 1080 images (see note)

a Basic Pattern 1 in figure C.1	d Gray	f 75% White	c 75% Yellow	c 75% Cyan	e 75% Green	c 75% Magenta	c 75% Red	f 75% Blue	d Gray
(a) Integer width (2048)	304	205	206	206	206	206	206	205	304
(b) Compatible width (2048)	304	206	206	206	204	206	206	206	304
(c) Modified 4:3 width (2048)	300	210	206	206	204	206	206	210	300

Table C.2 – Bar widths for pattern 4 - 2048 x 1080 images (see note)

4/3 b Pattern 4 in figure C.1	k 0% Black	g 100% White	h 0% Black	i -2 / 0 /+2 Black	j 0 / +4 Black	m 0% Black
(a) Integer width (1440)	309	411	171	69/68/69	68/69	206
(b) Compatible width (1440)	308	412	170	68/70/68	70/68	206
(c) Modified 4:3 width (1448)	312	412	170	68/70/68	70/68	210

Table C.3 – Bar widths for pattern 1 – 3840 x2160 images (see note)

a Basic Pattern 1 in figure C.1	d Gray	f 75% White	c 75% Yellow	c 75% Cyan	e 75% Green	c 75% Magenta	c 75% Red	f 75% Blue	d Gray
(a) Integer width (3840)	480	410	412	412	412	412	412	410	480
(b) Compatible width (3840)	480	412	412	412	408	412	412	412	480
(c) Modified 4:3 width (3840)	472	420	412	412	408	412	412	420	472

Table C.4 – Bar widths for pattern 1 – 4096 x2160 images (see note)

a Basic Pattern 1 in figure C.1	d Gray	f 75% White	c 75% Yellow	c 75% Cyan	e 75% Green	c 75% Magenta	c 75% Red	f 75% Blue	d Gray
(a) Integer width (4096)	608	410	412	412	412	412	412	410	608
(b) Compatible width (4096)	608	412	412	412	408	412	412	412	608
(c) Modified 4:3 width (4096)	600	420	412	412	408	412	412	420	600

Table C.5 – Bar widths for pattern 4 – 3840 x 2160 and 4096 x 2160 images (see note)

4/3 b Pattern 4 in figure C.1	k 0% Black	g 100% White	h 0% Black	i -2 / 0 /+2 Black	j 0 / +4 Black	m 0% Black
(a) Integer width (2880)	618	822	342	138/136/138	136/138	412
(b) Compatible width (2880)	616	824	340	136/140/136	140/136	412
(c) Modified 4:3 width (2896)	624	824	340	136/140/136	140/136	420

Table C.6 – Bar widths for pattern 1 – 7680 x4320 images (see note)

a **Basic Pattern 1 in figure C.1**	d Gray	f 75% White	c 75% Yellow	c 75% Cyan	e 75% Green	c 75% Magenta	c 75% Red	f 75% Blue	d Gray
(a) Integer width (7680)	960	820	824	824	824	824	824	820	960
(b) Compatible width (7680)	960	824	824	824	816	824	824	824	960
(c) Modified 4:3 width (7680)	944	840	824	824	816	824	824	840	944

Table C.7 – Bar widths for pattern 4 – 7680 x4320 images (see note)

4/3 b Pattern 4 in figure C.1	k 0% Black	g 100% White	h 0% Black	i -2 / 0 /+2 Black	j 0 / +4 Black	m 0% Black
(a) Integer width (5760)	1236	1644	684	276/272/276	272/276	824
(b) Compatible width (5760)	1232	1648	680	272/280/272	280/272	824
(c) Modified 4:3 width (5760)	1248	1648	680	272/280/272	280/272	840

C.2 Pattern Heights

The heights of the patterns in the color bar signal are specified as integer multiples of a common factor equal to the total number of vertical samples divided by 12.

Table C.8 – Pattern Heights

System	b	7/12 b Pattern 1	1/12 b Pattern 2	1/12 b Pattern 3	1/4 b Pattern 4	1/12 b Sub pattern *5, *6
2048 x 1080	1080	630	90	90	270	90
3840 x 2160 and 4096 x 2160	2160	1260	180	180	540	180
7680 x 4320	4320	2520	360	360	1080	360

Bibliography (Informative)

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